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# OBSERVATIONS RELATED TO THE DISTRIBUTION OF LANDFORMS, SOILS AND PERMAFROST IN THE MACMILLAN PASS AREA, Yukon

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# OBSERVATIONS RELATED TO THE DISTRIBUTION OF LANDFORMS, SOILS AND PERMAFROST IN THE MACMILLAN PASS AREA, Yukon

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Soils and surficial geology were mapped as part of a resource inventory in the MacMillan Pass area in east-central Yukon. The distribution of permafrost has been interpreted from detailed ground site information, the distribution of major landforms interpreted on aerial photographs, and the regional climate. Permafrost, though widespread in the area, is not continuous, with parts of the valleys remaining unfrozen. Permafrost is found very close to the surface on most lower and midslopes where shallow surficial deposits overlie the bedrock. Here, the most common soils found are Regosolic Static Cryosols and some Organic Cryosols. Most slopes show a rilled appearance, which is probably due to groundwater seepage and can be easily distinguished on aerial photographs. At higher elevations and on rockcored knobs, where bedrock is commonly at or just below the surface, permafrost is suspected at depth. Well drained, sandy morainal and glaciofluvial valley deposits probably contain permafrost at depths greater than those reached by most soil pits. Beneath larger streams and fens occupying valley floors, the ground is unlikely to be permanently frozen except under palsa and peat mounds.

Soils and surficial geology were mapped as part of a Resource Inventory of the MacMillan Pass area in east central Yukon on the Northwest Territories border. The northern part of the study area is in the Selwyn Mountains. The Hess, South MacMillan and Ross Rivers all flow through the study area.

The mapping of soils and surficial geology was facilitated by the development of terrain types characterized by similar or complexes of similar-morphology, genetic materials, soil development, drainage and permafrost conditions The terrain types were given names of local landforms.

The terrain types were selected to be distinguishable on 1:74,000 aerial photographs. Detailed sites served to define each part of the terrain types with respect to site conditions, parent materials characteristics, soil development and vegetation. soil pits averaged about 75 centimeters except where frost occurred near the surface.

Some common terrain types have been chosen to illustrate major relationships between landforms, soils, permafrost and vegetation found in the MacMillan Pass area. The schematic crossection shows the relative positions of these terrain types in the landscape. (Fig. 1)

## Selwyn

Terrain type Selwyn 1 includes most steep vegetated alpine slopes and ridges above 1500 meters. Surficial materials are dominantly sedimentary rocks of various lithologies and colluvium. Gullies are common on the slopes.

Soils are usually Orthic Dystric Brunisols and Orthic Humo Ferric Podzols. Orthic Regosols occur where there is little soil development. Eutric Brunisols occur on soils of higher pH associated with calcareous bedrock. Permafrost near the surface was found only on a few very steep north facing slopes. However, due to shallow snow cover on the exposed windswept ridges and low mean annual temperatures, permafrost is

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probable at depth. Vegetation varies over very short distances in these alpine areas; ground shrubs, grasses, lichen, forbs and mosses are common.

## Sheldon

Most steep subalpine slopes between approximately 1250 and 1550 meters have been classified as Sheldon terrain type. Soils are usually well drained rubbly loam Orthic Dystric Brunisols and Eluviated Dystric Brunisols. Permafrost was rarely found within the soil profile, however, it probably underlies most of these slopes at depth.

## South MacMillan

Morainal deposits and some colluvial and alluvial fan deposits, found on slopes below 1400 meters are often characterized by a streaked or rilled pattern. These slopes of the South MacMillan terrain type generally contain high ice permafrost within 50 centimeter of the surface. The ice is usually stratified and in the form of individual inclusions. Soils are usually poorly developed Regosolic Static Cryosols, with some Terric Fibric Organic Cryosols on poorly decomposed peat deposits The vegetation is usually mixed, composed of black spruce, alpine fir, some white spruce, shrubs, feathermosses and lichen. The distribution of lichen accents the rilled pattern.

## Deadmans

The Deadman terrain type consists of slopes with numerous bedrock knobs. Many of these are due to more resistant bands of sedimentary rock. The well drained soils on these knobs are non frozen within the soil profile and are usually classified as Eluviated and Orthic Dystric Brunisols. Bedrock is often very close to the surface. Vegetation is usually dominated by black spruce, shrub birch and lichen.

## Dragon

Glaciofluvial terraces, found along many valley floors are representative of the Dragon terrain type. These are usually dissected by more recent streams. These rapidly drained gravelly sand deposits are characterized by downward mobilization of iron and aluminum within the soil profile by organic chelates resulting in a greyish leached surface horizon overlying a red brown coloured B horizon; the soils are classified as Eluviated Dystric Brunisols or Orthic Humo Ferric Podzols. Shrub birch and lichen.

## Niddery

The mounded, channelled and gullied Niddery terrain type is associated with poorly sorted, brown coloured morainal deposits also occupying the valley floors. The mounds usually consist of a well drained gravelly loamy sand. Soils are most often classified as Eluviated Dystric Brunisols and Orthic Humo Ferric Podzols. Permafrost was not found on the mounds at shallow depths within the soil profile, except at one location. Narrow peat filled channels between the mounds, however, are usually frozen; shallow, poorly decomposed, Terric Fibric Organic Cryosols are the most common soils found The vegetation is dominantly shrub birch, lichen and moss, with black spruce common in the channels.

## Prevost

Imperfectly drained sandy and loamy alluvial deposits of the Prevost terrain type are found adjacent to many streams. Soils are usually classified as imperfectly to poorly drained Rego Gleysols, Permafrost was observed only where thermokarst features were present adjacent to silty glaciolacustrine deposits. Along major river valleys, these low terraces can support large stands of

white spruce; on smaller streams, shrubs and poplars are often found.

Gold

Many valley bottoms representative of the Gold terrain type are occupied by wetlands. Here a complex of organic and mineral soils are difficult to separate on aerial photographs. The peat deposits which may exceed 350 centimeters in some locaties appear to be unfrozen with Mesisol and Fibrisol soils. The vegetation of these fens is usually willow, sedge and moss. Underlying palsas and peat plateaus, soils are typically Fibric Organic Cryosols when frozen. On the poorly drained mineral soils, Rego Gleysols are most common.

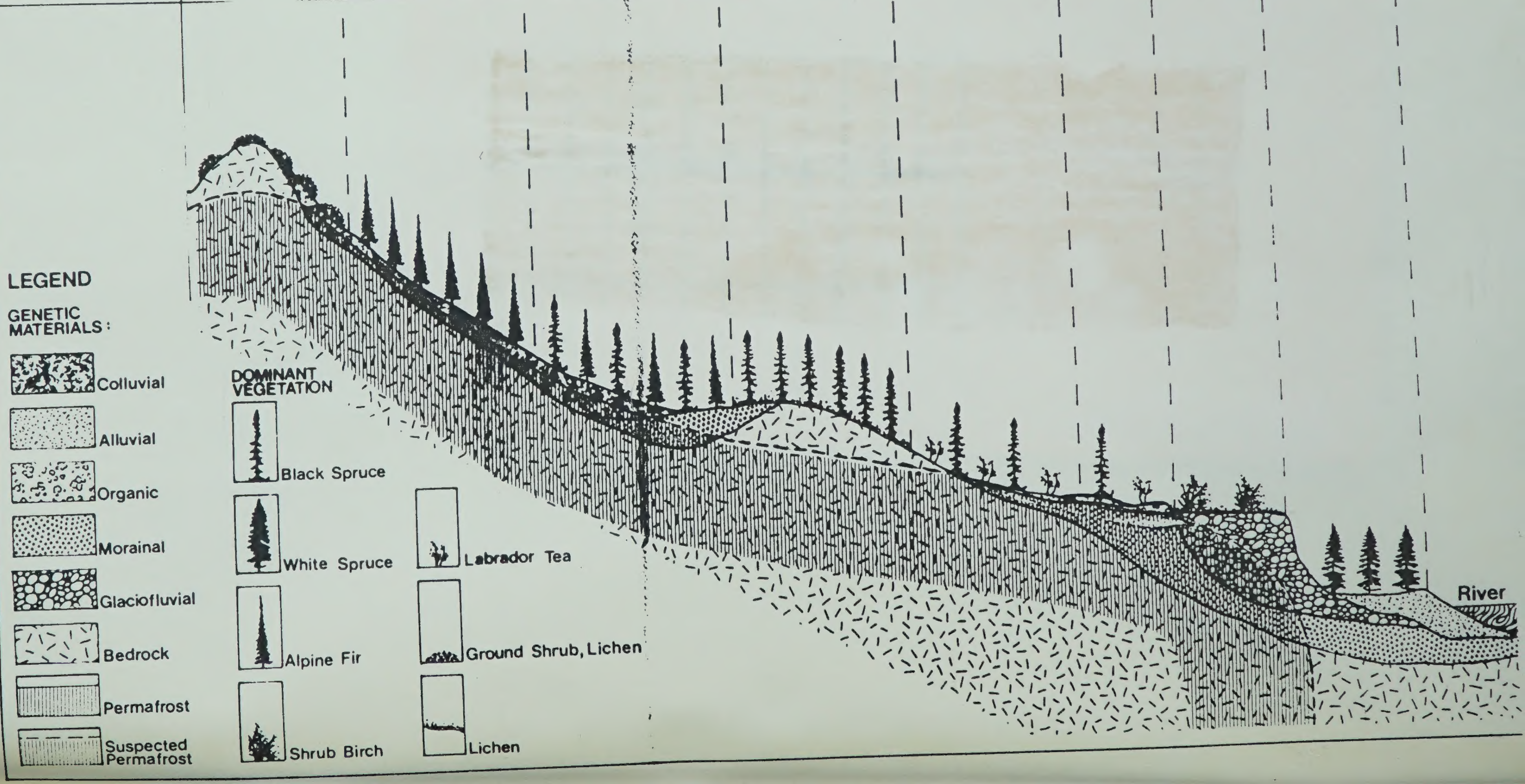
To summarize some of the observations related to the distribution of landforms soils and permafrost in the MacMillan Pass area:

Permafrost is widespread throughout the area. High ice permafrost is found near the surface on most mid and lower slopes, underlying palsas and peat plateaux found in some wetlands, and in thermokarsted silty lacustrine and alluvial deposits. Underlying most higher ridges, well drained knobs, and coarse and medium grained glaciofluvial and morainal deposits, permafrost is probably found at depth. Recent alluvial deposits and poorly drained wetlands probably do not contain any permanent ice. Soil development appears to be limited by the presence of permafrost near the surface. Regosolic Static Cryosols present on many slopes show little decomposition of the litter or mixing of vegetative matter with the mineral soil. Organic soils, when frozen, are typically poorly decomposed Fibric Organic Cryosols. Mesic, moderately decomposed, organic material is more common in unfrozen wetlands on the valley floors. Podzolic processes involving the downward mobilization of iron and aluminum within the soil profile are active in coarser grained deposits, where permafrost is not close to the surface.

Fig. 1

# COMPOSITE CROSS-SECTION/MACMILLAN PASS STUDY AREA

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SITE POSITION | Ridge Crest & Upper Slope | Upper Slope | Mid Slope | Rock Knob | Lower Slope | | Terrace | Alluvial Plain |
| SOIL ASSOCIATION | Selwyn (Se1) | Sheldon (Sh1) | South Macmillan (Sm2) | Dall Mountain (Dm1) | South Macmillan (Sm1) | | Dragon(Dr1)<br>Niddery(Ni1) | Prevost (Pr1) |
| SOIL SUBGROUP | O.DYB | O.DYB<br>R.SC | R.SC | O.DYB<br>E.DYB | R.SC | TMEOC | E.DYB | GL.R |



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